REMARKS

Prior to this Amendment, claims 1-34, 37-40, and 59-66 were pending in the application.

Claim 1 is amended to clarify that the reflective support is not merely a part of the wafer being tested but is, instead a separate element from the wafer (i.e., not one layer within a multi-layer thin film device). New claim 67, which depends from claim 1, is added to further emphasize that the method may involve illuminating the wafer with radiation at a wavelength corresponding to a moderately absorbing region of the wafer (whereby the reflective support is used to extend reflectance in this moderately absorbing region).

Independent claim 59 is amended to highlight that a thin wafer being examined is placed on a support that has a layer of reflecting material abutting a lower surface of the thin wafer (e.g., the support is a component outside and separate from the layers of wafer with a layer of reflecting material used to support the wafer and its layer(s)). Claims 60 and 62, which depend from claim 59, are cancelled.

Independent claim 64 is amended similarly to claim 1 to clarify that a lower external (or externally exposed) surface is placed in abutting contact with a reflecting surface of a support platform, which is a separate component from the wafer (e.g., not merely a layer or subpart of the wafer being tested). Claim 65, which depends from claim 64, is cancelled.

After entry of the Amendment, claims 1-34, 37-40, 59, 61, 63, 64, 66, and 67 remain for consideration by the Examiner.

Claim Rejections Under 35 U.S.C. §102

In the Office Action mailed October 29, 2008, claims 1-34, 37-40, and 59-66 were rejected under 35 U.S.C. §102(b) as being unpatentable over U.S. Pat. No. 4,625,114 ("Bosacchi"). Claims 60, 62, and 65 are cancelled. The rejection of claims 1-34, 37-40, 59, 61, 63, 64, 66, and 67 is traversed based on the following remarks.

Prior to turning to the specific claim language and the Examiner's rejections, it may be useful to more generally describe aspects of Applicant's described methods for determining thickness and other characteristics of a thin film component or wafer. As

noted in lines 22-32 on page 4 of Applicant's specification, the solar energy and other industries continue to search for methods and systems that can provide meaningful results for wafers that may have substantial surface texture/roughness and/or substantially non-parallel surfaces (e.g., non-uniform thickness of the overall wafer and not just particular layers). In lines 10-16 on page 5, it was noted that the inventor had determined that radiation with wavelengths corresponding to moderately absorbing regions are more suitable for determining wafer thickness, and it may be beneficial to position a wafer that is to be tested on a reflecting support to extend a reflectance range or increase reflectance in the moderately absorbing region.

On page 14 beginning at line 10, Applicant describes with reference to Figure 3 three regions including a region of moderate wavelengths where moderate absorption occurs "which are effected by surface characteristics of both the upper surface and the lower surface of the wafers" (both external/outer surfaces of a wafer or thin film device). From Figure 3 it can be seen that the difference of absorption between wafers of differing thickness is greater, which makes determination of thickness of a wafer more effective/accurate in this region. Beginning at line 5 of page 17, Applicant explains how the positioning of a wafer (and its one or more thin film layers) on a reflecting support acts to "extend total reflectance in a moderately absorbing region, which may enhance measurement sensitivity. On page 18, it is noted that it may be useful to use radiation with wavelengths specifically falling in this moderately absorbing region (e.g., see Figure 6) and that the reflecting support may be useful to practice the method when it "has properties of an aluminum reflector suitable for use in a reflectometer." The claims have been amended and/or drafted to protect these and other aspects of the described method or system that are not shown or suggested by Bosacchi.

In regard to the Examiner's Response to Arguments, the Examiner disagrees with Applicant's prior assertion that Bosacchi fails to show use of a reflective support or a reflective coating on the second surface of the wafer." Initially, Applicant has amended the claims so that there is no confusion as to whether a layer of a thin film device or wafer may teach the coating limitation by deleting that limitation from the claims. The claims now all call for a support with a reflecting surface positioned so as to support a lower/second external surface of a wafer that is being tested via

illumination (generally radiation with a wavelength selected to correspond to the moderately absorbing region of the wafer).

The Response to Arguments asserts that a reflecting support is shown in Bosacchi in its Figure 3, which shows light 32 passing through a first layer d_1 of a thin film device/wafer 25 and being reflected from a second layer d_2 of the device/wafer 25. Applicant strongly disagrees. Bosacchi in Figure 4 shows that the structure/wafer 25 is placed "against a block 45 in intimate contact with the bottom surface of the multilayer thin film structure" (see col. 8, lines 34-39). There is no discussion whatsoever that the block 45, which Applicant asserts is comparable to the support of the claims, is reflecting or has a reflective surface that is in intimate contact with the bottom surface of the wafer/multilayer device 25. Figure 3 shows that its device may be useful for determining internal reflectance due to the interface between various layers of a multilayer device.

However, it does not teach placing the device 25 on a reflecting support, and Applicant has amended the claims to clarify that the support is a separate component/item from the wafer/device being tested (e.g., cannot simply be a layer of a device 25 but has to be a separable component). In part, the amendments call for external surfaces to receive the radiation and to abut the support (and its reflecting surface). Applicant notes that if the structure 25 is being asserted as being the wafer of the claims then all of its layers are part of the structure/wafer and cannot also teach the separate claim element/limitation of a support, and this is especially true in light of the limitations calls for an external surface of the structure/wafer 25 to abut the support.

Further, Applicant notes that the Response to Arguments does not address Applicant's arguments regarding the lack of specific citations regarding the dependent claims. Additionally, several claims, including independent claim 59, call for the radiation to be provided at a wavelength corresponding to the moderately absorbing region of the wafer, and thus far, the rejections have provided no specific citation to Bosacchi indicating how/why the Examiner believes this reference teaches or suggests this limitation (and Applicant could find no relevant teaching in the reference regarding these claim limitations).

Claim 1 is directed toward a method that includes illuminating a first surface of a wafer with radiation and positioning the second surface on a reflective support that is a separate element from the wafer being illuminated. The method also includes receiving a signal with information germane to total reflectance of the radiation from the wafer. The information of the signal is compared to information in a database to determine characteristics of the wafer including thickness and surface roughness or the like.

Bosacchi fails to teach illuminating a surface of a wafer, which is placed on a reflective support, and then determining total reflectance of the radiation/light that is directly incident on the wafer as a manner of determining thickness and surface characteristics of the wafer.

Further, Bosacchi fails to show the use of a reflective support to support the second surface of the wafer. As explained at least with reference to Figures 5 and 6 in Applicant's specification, use of such a reflective support or coating "extends the range or bounds of total reflectance" in a region of wavelengths where moderate absorption of the radiation occurs. The Applicant determined that it would be useful to extend this region (Region II in his specification) because in regions of high or low absorption there is less difference between wafers of differing thickness, which makes determination of wafer thickness when considering the signals from the wafers in these regions. For example, in Figure 6, there is basically no difference in the total reflectance of two wafers in a first region of higher absorption (and less total reflectivity) whereas in a second region of moderate absorption there is a larger differential. This makes it easier to determine thickness and other characteristics by comparing information such as total reflectivity in this second region of moderate absorption, and the use of a reflective platform or a reflective coating extends this region of moderate absorption.

The Office Action cites Bosacchi at col. 8, lines 3-60, col. 12, line 65 to col. 13, line 8, col. 9, lines 45-65, and col., 12, lines 30-65, and photodetector 50 in Figure 4 as showing all the limitations of claim 1. Also, these same citations were cited as showing the limitations of dependent claims 2-40, but no specific citation was provided for each additional limitation of all of these dependent claims.

Regarding claim 1, Bosacchi fails to show use of a reflective support to support a second surface of the wafer, with the support being a separate component from the

wafer. Instead, Bosacchi's Figure 4 shows that a multilayer thin film wafer 25 is positioned between a surface 36 of support member 35 and a block 45. There is no discussion in the specification when describing Figure 4 that it would be useful to have the block 45 be a reflective support. Note, the block 45 is the only separate component used to support the wafer 25 shown by Bosacchi. Hence, Bosacchi fails to anticipate each limitation of claim 1.

As discussed above with regard to the Response to Arguments, it appears that the Examiner is attempting to liken the layer d_2 of the device/wafer 25 as shown in Figure 3 to the reflective support of claim 1. However, claim 1 requires that the wafer, i.e., the entire device/wafer 25, be supported by the reflective support and not just a layer or portion of the wafer. Further, claim 1 calls for the support to be a separate component such as shown in Applicant's Figure 12, and such an arrangement seems to require that the Bosacchi support 45 shown in its Figure 4 be reflective to teach/suggest the illuminating step of claim 1. However, the layer d_2 is not a separate component and it does not support the device 25 but instead it is part of the device 25 itself. For these reasons, Applicant requests that the Examiner reconsider his rejection of claim 1 based on this reference and find claim 1 allowable in light of the teaching of Bosacchi.

Further, Bosacchi provides no suggestion of the desirability of extending the moderate absorption region for use in analyzing wafers' thicknesses and characteristics based on total reflectance (or even a mention of the possible importance of such as region of absorption), which is why it may be desirable to have the block 45 be a reflective support. Since the use of a reflective support that is separate from the wafer (separate from device/structure 25 and not an integral layer) limitation is not shown or suggested, claim 1 is believed allowable over the teaching of Bosacchi.

Further, Bosacchi does not merely call for illuminating a first surface of a wafer with radiation and then obtaining a signal based on "total reflectance" of the radiation as called for in claim 1. Instead, Bosacchi teaches in the cited col. 8 and elsewhere use of the "principles of frustrated total reflectance." To this end and with reference to Figures 1-3, Bosacchi discusses use of collimated light from a laser, abutting a specially designed coupler to the upper surface of the wafer, and significance of an air gap, which are not called for or needed in the method of claim 1. For this additional reason,

claim 1 is not shown by Bosacchi. The Response to Arguments fails to address this reason for finding claim 1 allowable over Bosacchi.

Applicant also notes that Bosacchi differs from the methods taught by Applicant as it uses frustrated total reflectance (in contrast to radiation transmitted directly onto a wafer surface) and a coupler (rather than a source providing radiation directly incident on the wafer surface), while also teaching that total internal reflectance couples light to the test wafer, only a very small area measurement where laser strikes surface, and reflectance is measured as a function of angle.

Claims 2-34 and 37-40 depend from claim 1 and are believed allowable over Bosacchi at least for the reasons provided for allowing claim 1 over this reference. Further, claims 11 and 13 specifically call for the signal to be acquired with non-contact techniques whereas Bosacchi teaches that is coupler is generally placed in contact with the wafer but some airgaps will occur with a wafer having a surface roughness. Claim 18 calls for the signal to be acquired using a Sopori reflectometer while claim 19 calls for use of a PV reflectometer. Bosacchi fails to teach use of either of these devices, and the Office Action fails to provide a particular citation to Bosacchi for these limitations. Claim 26 calls for "selecting a total reflectance value and correlating the selected value to a wavelength" (e.g., see Applicant's Figure 6), and Bosacchi fails to discuss such steps in its data analysis. Claim 27 further calls for the wavelength to be within a range of wavelengths (e.g., associated with the moderate absorption range or multiple internal reflections as called for in claim 28). For these additional reasons, Bosacchi does not anticipate claims 11, 13, 19, and 26-28. The Response to Arguments fails to address any of these arguments for allowing these claims that depend from claim 1.

Additionally, claim 67 was added that depends from claim 1. This claim calls for the illuminating step to be performed "using radiation at a wavelength corresponding to a moderately absorbing region of the wafer." Applicant has reviewed Bosacchi and has found no suggestion in this reference of selectively using radiation in a moderately absorbing region of the structure 25 (or its layers) or why this would be useful/desirable. Further, the Examiner has provided no discussion of this aspect of Applicant's claims,

and Applicant requests that claim 67 be found allowable or that the Examiner provide a citation to Bosacchi or another reference showing this limitation.

In the prior Amendment, independent claim 59 was added and is directed to a method with limitations similar to that of claim 1, and the Office Action rejects claim 59 for the same reasons provided for rejecting claim 1 based on Bosacchi. Hence, the reasons for allowing claim 1 over Bosacchi are applicable to claim 59 (e.g., Bosacchi does not teach placing a thin wafer on a support, which has a layer of reflecting material because its block 45 is not taught to be reflecting).

Further, independent claim 59 calls for "identifying for the thin wafer a moderately absorbing region of wavelengths of radiation" and for a reflectometer illuminating "an upper surface of the thin wafer with radiation having one or more wavelengths corresponding to the moderately absorbing region." The Office Action fails to provide any discussion of these features, which are not found in claim 1, and it also fails to provide any specific citations to Bosacchi with regard to these limitations. Further, the Response to Arguments does not address these limitations. Hence, the Office Action fails to state a proper *prima facie* case of anticipation of claim 59 based on Bosacchi.

The benefits of such a method are explained above in Applicant's comments regarding his specification (e.g., use of such wavelengths increases the efficacy of the test in determining wafer thickness). Applicant has reviewed Bosacchi and could find no discussion of using wavelengths within a moderately absorbing region of the structure 25. The Examiner is requested to explain how Bosacchi teaches these additional limitations – not found in claim 1 – or to find claim 59 allowable over this reference.

Claim 61 depends from claim 59 and is believed allowable over Bosacchi at least for the reasons provided for allowing claim 59 over this reference. Further, claim 61 specifically calls for the reflective support to comprise an aluminum reflecting support, and the block 45 and the layer d_2 (which is an intermediate layer of a multilayer device, which would teach away from use of a highly reflective material as transmissivity would typically be desired/required) are not taught by Bosacchi as being an aluminum

reflective surface. For this additional reason, claim 61 is believed allowable over Bosacchi.

Dependent claim 63 calls for two or more radiation sources to be used, and, again, the Office Action fails to discuss this limitation or provide any citation to Bosacchi. Bosacchi in Figure 4 appears to only show one radiation source, and, hence, its teaching cannot anticipate claim 63.

Independent claim 64 is directed to a method with limitations similar to those found in claims 1, and the reasons for allowing claim 1 over Bosacchi are believed applicable to claim 64. Claim 66 depends from claim 64, and it is believed allowable at least for the reasons for allowing claim 66. Further, claim 66 adds the limitation regarding the range of wavelengths being in a region of moderate absorbancy of radiation for the wafer, and, hence, the reasons for allowing claim 59 (and new claim 67) over Bosacchi are applicable to claim 66.

Conclusions

In view of all of the above, it is requested that a timely Notice of Allowance be issued in this case.

No fee is believed due with this submittal. However, any fee deficiency associated with this submittal may be charged to Deposit Account No. 140460.

Respectfully submitted,

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Dated: June 8, 2009

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